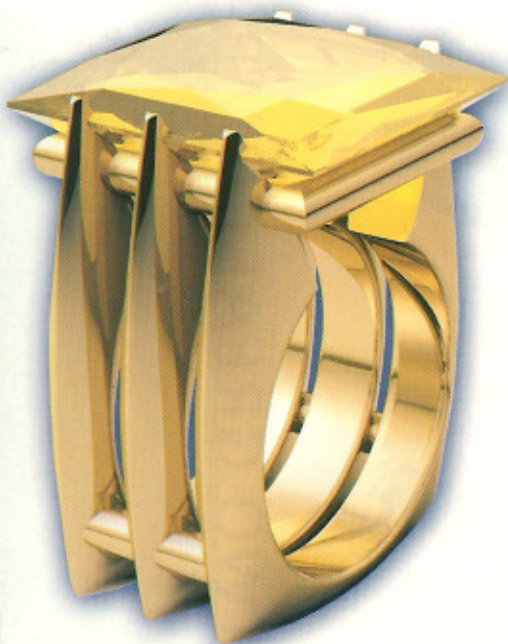


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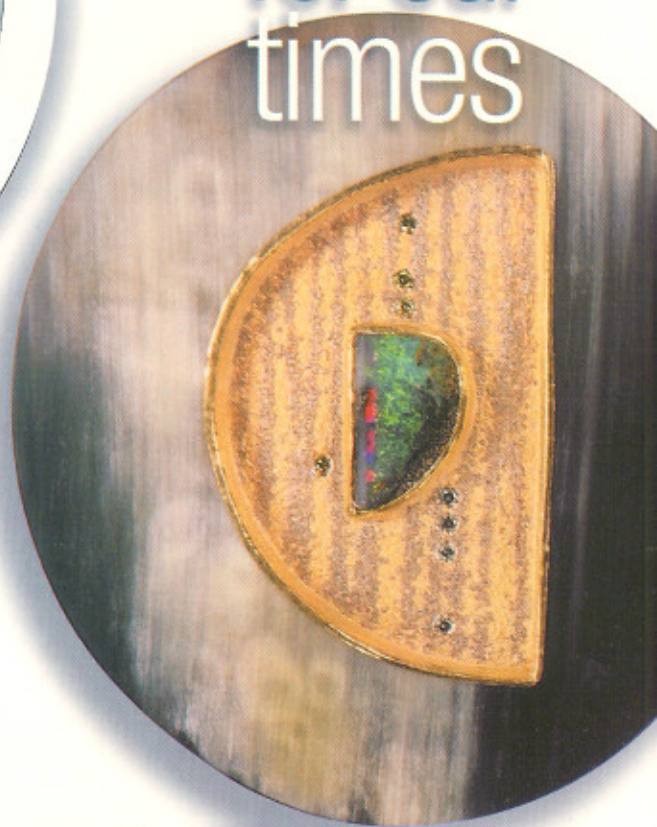
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# Peering Into Emerald's Origins

BY ANNE SASSO

The French researchers responsible for unraveling the geological story of Colombian emerald formation are back, this time with a new method — non-destructive, cheap, quick, and effective, they say — to uncover the stone's provenance.

"There's a unique isotopic signature specific to each emerald deposit we have studied, much like a fingerprint or even a mineral genome," says Alain Cheilletz, the lead researcher on the team.

The group hails from the National Polytechnic Institute of Lorraine (INPL) in Nancy, France, where research was conducted in partnership with France's National Center for Scientific Research (CNRS). The same researchers made headlines in 2000 when they announced a method of tracing emerald origin using the ratio of oxygen isotopes in a sample. The ratio provided the equivalent of a GPS reading to the region in which a stone was mined.

However, the technique required specialized equipment: an ion microprobe, which vaporized a minute portion of the gem. "It's an expensive, cumbersome technique that can't be used routinely in a gemological lab doing certification," says Cheilletz. Plus, there was overlap in the signatures; it was impossible to distinguish between stones from Brazil and Zambia, for example. They needed a better method.

Now Cheilletz and co-workers Philippe de Donato and Odile Barres have developed a new analytical technique using an instrument common to most gem testing labs: an infrared (IR) spectrometer. By adding a microscope attachment, they were able to

shine infrared light onto key portions of the emeralds' microstructure.

What they found was a special type of water imprisoned within the crystal structure — water in which an atom of deuterium, a heavy version of common hydrogen, replaces an hydrogen atom. The chemical bonds between the oxygen and deuterium atoms in the emerald absorb the infrared light in such a way as to provide a unique signature.

"We noticed that these absorption bands were specific for each of the great deposits of the world," says Cheilletz. The method also easily identifies synthetic gems and any resin or oil in the fractures of the stone.

The researchers don't fully understand yet why the signatures are unique, but it has allowed them to distinguish between emeralds from Madagascar, Russia, Zambia, and Brazil. "We can also differentiate Colombian stones with certainty from others in the world," says Cheilletz. They have even observed variations between different regions in Colombia, and they are trying to further refine the method to identify the signatures of stones from individual mines.

Experts aren't so sure that's necessary. "No one walks into a store and asks for [an emerald from] Chivor," says Fred Ward, author of *Emeralds*. "They



ask for a Colombian emerald. I would be happy if [the French researchers'] method could just hit it firmly and call it Colombian. I think that would be a great advance."

IR spectroscopy is used routinely in gemological labs to help differentiate between mineral species — whether your green stone is an emerald or a peridot, for example — and to detect the enhancement of emeralds by resin or oil. Determining a stone's origin is much more involved and costly.

The American Gem Trade Association Gem Testing Center (AGTA GTC) in New York and the SSEF Swiss Gemmological Institute in Basel, Switzerland, use a variety of techniques — including microscopic examination of inclusions, Raman spectroscopy, UV visible spectrometry, trace element chemistry, and IR spectroscopy — to determine a stone's origin. "A combination of all these methods is used. It may be that one will be sufficient to identify an origin, or it may be that you need to run all the techniques. It will depend on the stone," says Ken Scarratt, director of the AGTA GTC. He adds that he hasn't yet had an opportunity to review the new research, but is optimistic about its possibilities.

The French INPL/CNRS team is in negotiation to license their new technology to the Colombian gov-

ernment and help establish a certification lab for the country's stones. "When you buy coffee from Colombia, you know what you're getting. When you buy emeralds from Colombia today, you don't always know what you're getting," says Cheilletz. His team hopes that their method will allow Colombia to brand its emeralds and improve the product's image in the international market.

Ward is dubious. "I would prefer that Colombian emerald testing not be done in Colombia," he says. "I think they would always be suspect because they have a financial interest. In order for it to succeed, whoever is providing certification must be divorced from the trade," he adds.

Scarratt of the AGTA GTC agrees. "An independent laboratory in producing nations such as Colombia would add a lot of credibility to the product. And again, I emphasize independent," he says.

That news of the new technique met with mixed reactions at this year's Tucson show was no surprise to Ward. "Some dealers don't really want a quick and inexpensive test, because they're calling anything that looks pretty good Colombian and getting away with it," he says. "However, if you have legitimate Colombian emeralds with papers to prove it, you could probably sell them for a higher price than those from Brazil or Africa." ○

Illustration by Kevin Myers. Emerald photo by John Parrish.